

## NOTES ON AUSTRALIAN VERRUCARIACEAE (LICHENISED ASCOMYCOTINA): 3

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### ABSTRACT

McCarthy, P.M. Notes on Australian Verrucariaceae (lichenised Ascomycotina): 3. *Muelleria* 8(2): 99–105 (1994). — *Verrucaria meridionalis* P.M.McCarthy *sp. nov.* is described from maritime rock in southern New South Wales. *Endocarpon pallidulum* (Nyl.) Nyl. and *V. lecideoides* var. *minuta* Hepp are reported for the first time from Australia. New state records are provided for *Thelidium papulare* (Fr.) Arnold (Tasmania), *V. australiensis* P.M.McCarthy (Victoria and Tasmania) and *V. subdiscreta* P.M.McCarthy (New South Wales).

### INTRODUCTION

Research on the lichen family Verrucariaceae continues to improve its known representation in Australia. In this paper, a new species is described and new national and state records of five others are documented.

### TAXONOMY

1. *Endocarpon pallidulum* (Nyl.) Nyl., in Hue, *Nouv. Archiv. du Museum, sér. 3, 4*: 106 (1892). — *Verrucaria pallidula* Nyl., *Flora* 57: 73 (1874). — *Paracarpidium pallidulum* (Nyl.) Müll. Arg., *Flora* 66: 346 (1883).

TYPUS: Peru (San Martin Province), Tarapoto, on sandy soil, 1866, R. Spruce 196 (HOLOTYPE: H-NYL 2280!; ISOTYPE: G!).

*Thallus* terricolous or corticolous, squamose. *Squamae* closely appressed to bark, more loosely attached to soil, shallowly and irregularly lobate, contiguous to imbricate, plane to slightly convex, pale grey-green to medium olive-brown, becoming darker and more intensely green when wetted, 0.5–2(–2.5) mm wide, 0.08–0.1(–0.12) mm thick; lobes, in turn, frequently producing rounded, 0.1–0.2 mm wide, marginal lobules; surface smooth, matt; margin plane, smooth to lightly crenulate. *Cortex* (25–)30–40 µm thick, uniformly hyaline and paraplectenchymatous; cells thin-walled, more or less polygonal, 6–10(–12) µm wide. *Algal layer* 35–50 µm thick, continuous; cells green, ellipsoid to globose, (6–)8–12(–14) × 6–12 µm; interstitial cells thin-walled, 5–8(–10) µm diam. *Medulla* 20–30(–40) µm thick; hyphae loosely arranged, 2.5–4 µm wide, prosoplectenchymatous and with numerous air-spaces to almost paraplectenchymatous and with polygonal, 3–6 µm wide cells. *Lower surface* consisting of a 15–25 µm thick layer of pale to dark brown cells from which concolorous or paler, 3–4.5 µm wide rhizohyphae develop. *Perithecia* simple, immersed, usually solitary, 2–5(–8) per squama. *Perithecial apex* convex, concolorous with the thallus to dark brown, becoming noticeably darker when wetted with water, 0.1–0.16 mm diam. *Ostiole* inconspicuous to slightly depressed. *Centrum* obpyriform, 0.13–0.23 mm diam. *Excipulum* pale to dark brown at the base, becoming medium brown to brown-black near the apex, 15–20 µm thick. *Paraphyses* absent. *Periphyses* 25–35 µm long, simple to sparingly branched; lumina 1–2 µm wide; walls becoming gelatinized when wetted, 2–3 µm thick. *Hymenial algae* green, globose-cuboid, 2.5–3.5(–4) µm wide. *Hymenial gel* and subhymenium Lugol's I+ deep brown-red. *Asci* fissitunicate, bisporous, clavate to cylindroclavate, 60–74 × 14–18 µm.

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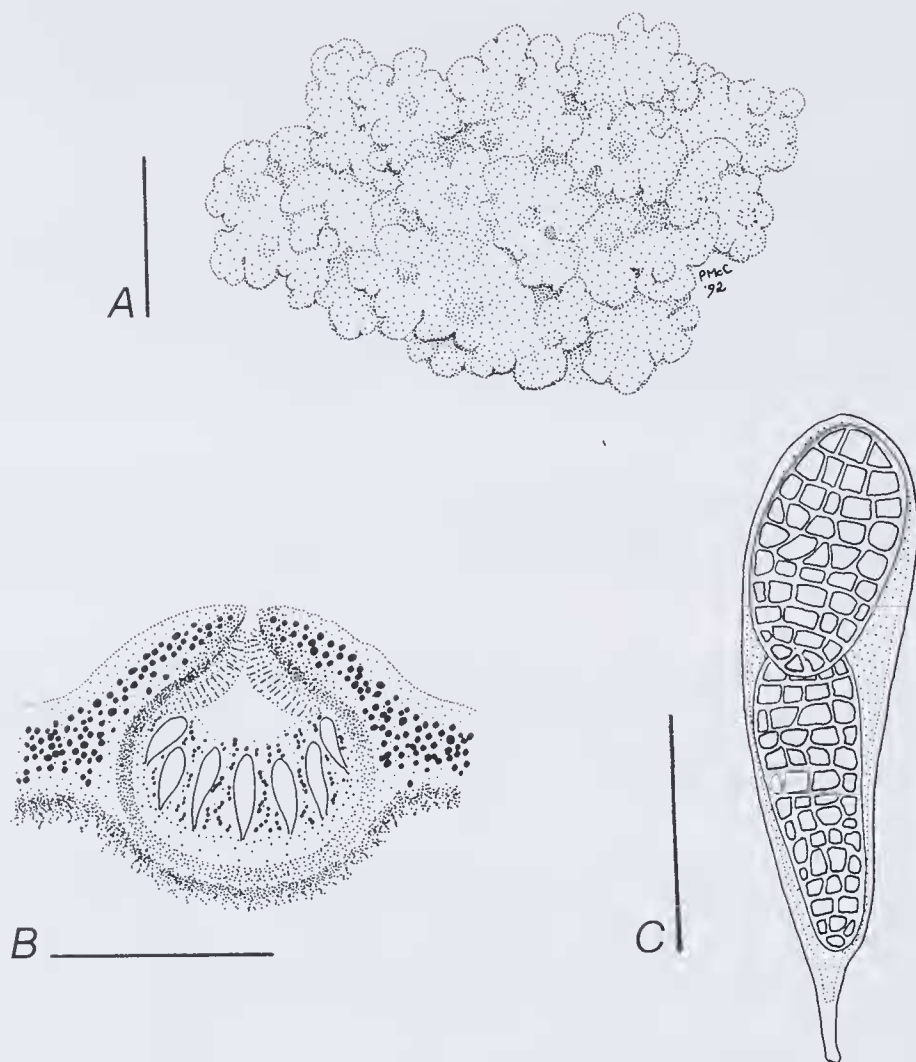


Fig. 1. *Endocarpon pallidulum*. a — habit; scale 0.5 mm. b — vertical section of perithecium and adjacent thallus; scale 0.2 mm. c — Mature ascus; scale 20  $\mu$ m. (All from *Aproot* 22132).

*Ascospores* muriform, colourless to pale yellowish-brown, broadly ellipsoid to elongate-ellipsoid to subcylindrical, with 9–12 transverse divisions and 3–4 longitudinal divisions,  $(22\text{--})29.5\text{--}(36) \times (9\text{--})12.5\text{--}(16) \mu\text{m}$  (70 measured). *Conidiomata* not seen. (Fig. 1)

#### NOTES

*Endocarpon pallidulum* has minute, closely appressed squamae and proportionately small perithecia that produce very small and persistently pale ascospores. It is known from sandy soil in its type locality in the foothills of the Peruvian Andes, from soil in Cuba (Müller 1885) and Japan (Nylander 1890) and, now, from tree-bark in north-eastern Queensland.

Among the *Endocarpon* species already known from Australia, *E. pallidulum* is most similar to the terricolous and saxicolous *E. pallidum* Ach. which has very small, pale squamae and colourless to pale brown ascospores in bisporous asci. However, the latter also has a broader, brown to brown-black perithecial apex and a 0.24–0.28 mm diam. centrum. Moreover, the asci and ascospores are 74–97  $\times$

19–26  $\mu\text{m}$  and  $25\text{--}49.5 \times 14.5\text{--}19 \mu\text{m}$ , respectively (McCarthy 1991a). A depauperate corticolous specimen from Victoria cited by McCarthy (1991a) is unlikely to be conspecific with *E. pallidum* because, not only does the former have larger and more deeply lobate squamae, its ascospores are brown, even when immature.

This lichen is exceptional, not only in terms of its morphology, but also in its substratum and tropical location. The ten taxa hitherto known from Australia are predominantly terricolous and are mostly restricted to arid to cool-temperate habitats in central and southern latitudes (McCarthy 1991a).

#### ADDITIONAL SPECIMENS EXAMINED

**Australia** — *Queensland* — Cairns, Botanical Garden, near Centenary Lakes, alt. 5 m, on the bark of a cultivated tree, Mar. 1988, *A. & M. Aptroot* 22230 (MEL 1057427, Herb. Aptroot); Cairns, on cultivated tree on The Esplanade, Mar. 1988, *A. & M. Aptroot* 22132 (MEL 1057428, Herb. Aptroot).

**Cuba** — on soil, 1856–58, *C. Wright* [*Verrucariae Cubenses* 188, 189, Ser. 2: 536 (G, H-NYL 2277)].

#### 2. *Thelidium papulare* (Fr.) Arnold, *Flora* 68: 147 (1885).

Earlier papers in this series (McCarthy 1990, 1991b) noted the occurrence of *T. papulare* in New South Wales and Victoria. The first Tasmanian record, reported here, has a somewhat thicker thallus than those of the mainland specimens; perithecial characters, however, are almost identical.

#### SPECIMEN EXAMINED

**Tasmania** — Vale of Bellevoir, on limestone outcrop in buttongrass (*Gymnoschoenus*) moorland, alt. 840 m, 16 May 1987, *G. Kantvilas* 62/87 (HO 122951).

#### 3. *Verrucaria australiensis* P.M. McCarthy, *Muelleria* 7: 320 (1991)

First described from coastal limestone in South Australia (McCarthy 1991b), *V. australiensis* has since been collected in similar habitats in Victoria and on Erith Island in the Bass Strait. The thalli of the recent collections are endolithic and the perithecia are simple and semi-immersed in the substratum. While the perithecia of the Tasmanian specimen are virtually identical in all respects to those of the type, in the Victorian lichen they are somewhat larger [(0.12–)0.17 (–0.2) mm diam.] and contain ascospores of  $(7.5\text{--})9\text{--}(11.5) \times (4\text{--})5.5\text{--}(7) \mu\text{m}$ .

#### SPECIMENS EXAMINED

**Victoria** — Mornington Peninsula, Blairgowrie, Cape Schanck Coastal Park, Spray Point, on dune limestone in the upper supralittoral, alt. 5 m, 5 Jan. 1990, *P.M. McCarthy* 355 (MEL).

**Tasmania** — Bass Strait, Kents Group, Erith I., south-western coast, on sheltered limestone, 26 Oct. 1992, *J.S. Whinray* 2682 (MEL).

#### 4. *Verrucaria lecideoides* var. *minuta* Hepp, *Lich. Eur.*: 683 (1860).

**TYPUS:** (Germany, Bayern, 40 km NNE of Nürnberg), Streitberg, on limestone, *F.C.G. Arnold* (ISOTYPUS: MEL!).

*Thallus* crustose, epilithic, determinate, pale to medium greenish grey to grey-brown, areolate, 80–120  $\mu\text{m}$  thick. *Areolae* (0.1–)0.15–0.35(–0.6) mm wide, angular (when contiguous) to rounded (when scattered), plane to slightly convex; surface matt, smooth. Side-walls of closely packed areolae pallid to dark brown; walls tend to be pallid when areolae are more scattered. *Epinecral layer* uniformly 10–30  $\mu\text{m}$  thick or uneven. *Cortex* composed of 1–2 layers of 2.5–4  $\mu\text{m}$  diam. cells, with thick, hyaline to brown walls. *Algae* green, globose, 7–12(–15)  $\mu\text{m}$  diam.; interstitial cells thin-walled, 2–4  $\mu\text{m}$  diam. *Prothallus* dark grey to black or not apparent. *Hypothallus* not apparent. *Perithecia* very numerous, 2/3–1/3 immersed to almost superficial, at the margins of, or between areolae, usually solitary, (0.12–)0.17(–0.24) mm diam. *Perithecial apex* slightly to strongly convex. *Ostiole* inconspicuous or in a 20–40  $\mu\text{m}$  wide depression. *Involucrellum*

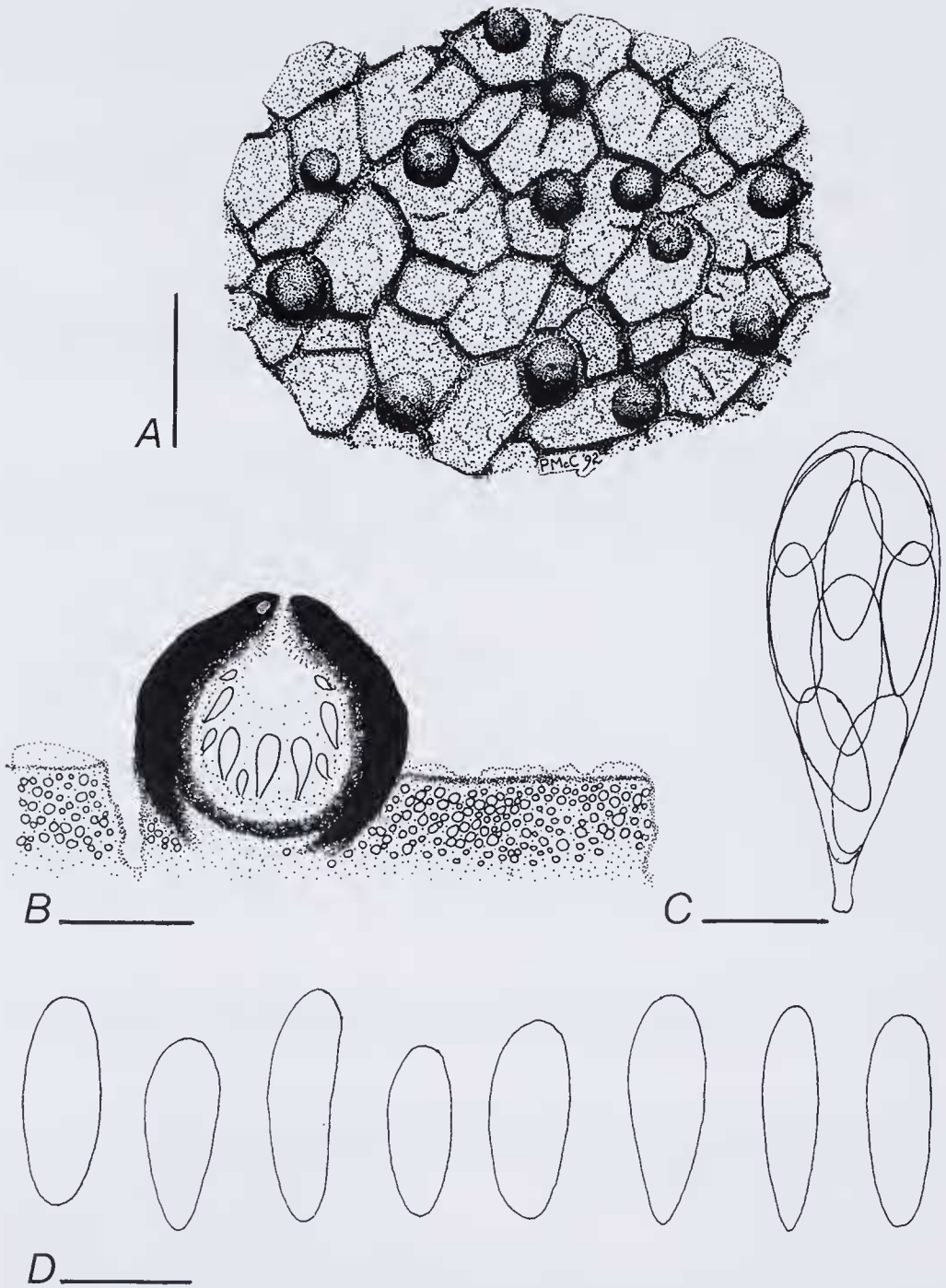


Fig. 2. *Verrucaria lecideoides* var. *minuta*. a — habit; scale 0.5 mm. b — vertical section of perithecium and adjacent thallus; scale 0.1 mm. c — ascus; scale 10  $\mu$ m. d — ascospores; scale 10  $\mu$ m. (All from Ewers 6957).

black, contiguous with the excipulum and extending to excipulum-baselevel, 25–45  $\mu$ m thick. *Excipulum* hyaline to greenish black, 15–20  $\mu$ m thick. *Centrum* globose to obpyriform, 0.08–0.12 mm diam., IKI+ red-brown. *Periphyses* simple, 15–20  $\times$  2–3  $\mu$ m. *Paraphyses* absent. *Asci* fissitunicate, clavate, 8-spored, 39–53  $\times$

13–17  $\mu\text{m}$ . *Ascospores* simple, colourless, narrowly to broadly ellipsoid, massed or irregularly biseriate in the asci, (9–)13(–18)  $\times$  (5–)6.5(–8)  $\mu\text{m}$  (73 measured); contents clear to granular-guttulate. (Fig. 2).

#### NOTES

*Verrucaria lecideoides* var. *minuta* has a deeply areolate thallus, minute perithecia and rather small ascospores. Its most distinctive character is the occurrence of the perithecia at the margins of and, frequently, between areolae. While this last feature readily distinguishes it from other *Verrucaria* species known from Australia, it is an attribute common to several Eurasian taxa.

*Verrucaria lecideoides* var. *lecideoides* (Massal.) Trevisan and *V. gebennica* Nyl. have larger and more deeply immersed perithecia with thicker, strongly flattened involucrella (Servit 1954, Wirth 1980, Clauzade & Roux 1985, McCarthy 1988; specimens examined in G, GZU, H, UPS and W). *Verrucaria beltraminiana* (Massal.) Trevisan, known from limestone in Germany and Italy, has a thicker, paler thallus with a well-defined medulla. The perithecia are larger, but more deeply immersed, the asci are discontinuously longer and the ascospores are longer and broader (Zschacke 1933, Servit 1952, Wirth 1980, Clauzade & Roux 1985). *Verrucaria fraudulosa* Nyl, the only obligately silicolous member of this group, has strongly convex areolae, 0.2–0.34 mm diam. perithecia and 13–22  $\mu\text{m}$  long ascospores [TYPUS: Germany, Heidelberg, on granite, 1860, *W.R.vonZwackh* (SYNTYPUS: H-NYL 2741!)].

*Verrucaria lecideoides* var. *minuta* has been reported from Poland, Czechoslovakia, Germany, Switzerland, Austria, Italy and from the northern and Mediterranean coasts of France (Zschacke 1933, Lettau 1940, Servit 1954, Nowak & Tobolewski 1975, Roux 1984 and others). While almost all reports have cited calcareous substrata, Lettau (1940) listed a specimen on sandstone from Thüringia, Germany.

The Australian specimens are exceptional in that all are silicolous in areas that are more arid than those hitherto reported for this lichen. However, the environmental anomalies are outweighed by a similarities in thalline anatomy and by uniformity in the placement and structure of the perithecia.

#### SPECIMENS EXAMINED

*South Australia* — Arkaroola, on hard siliceous rocks, 18 June 1990, *W.H.Ewers* 6957 (MEL).

*New South Wales* — 5 miles [8 km] E of Cooma, by road to Numeralla, on granite outcrops in grassland, 2 Oct. 1967, *W.A.Weber* & *D.McVean* (COLO-L 49061); Sofala, on parapet of Crossley Bridge, over Turon R., on sandstone pebbles embedded in cement, 11 Feb. 1991, *P.M.McCarthy* (MEL).

#### 5. *Verrucaria meridionalis* P.M.McCarthy, *sp. nov.*

Thallus epilithicus, viridis vel viridiater, continuus, madefactus gelatinosus, (15–)20–25(–30)  $\mu\text{m}$  crassus. Perithecia hemisphaerica vel subglobosa, (0.24–)0.35(–0.45) mm diametro. Apex perithecii convexus. Involucrellum atrum, ad basim excipuli descendens. Centrum 0.15–0.2 mm diametro. Excipulum fuscoatrum, 18–25  $\mu\text{m}$  crassum. Periphyses simplices, 25–40  $\times$  1.5–2.5  $\mu\text{m}$ . Asci 36–42  $\times$  12–17  $\mu\text{m}$ . Ascosporae ellipsoideae vel globosae, (7–)10(–12.5)  $\times$  (5.5–)8(–10.5)  $\mu\text{m}$ .

TYPUS: Australia, New South Wales, Narooma District, Bodalla State Forest, 7 km E of Narooma, Wagonga Inlet picnic site, on shale in the upper littoral, 5 Feb. 1991, *P.M.McCarthy* 475 (HOLOTYPUS: MEL 1055262; ISOTYPUS: NSW).

Thallus crustose, epilithic, effuse to determinate, dark olive green to black, continuous, filmy, gelatinous when wetted, (15–)20–25(–30)  $\mu\text{m}$  thick, the uppermost 5–8  $\mu\text{m}$  darkly pigmented. *Algae* green; cells broadly ellipsoid to globose, 4–6(–7)  $\times$  4–6  $\mu\text{m}$ . *Hyphae* 3–4(–5)  $\mu\text{m}$  wide. *Prothallus* black, discontinuous. *Perithecia* compound, superficial, hemispherical to subglobose, numerous, usually solitary, (0.24–)0.35(–0.45) mm diam. *Perithecial apex* rounded. *Ostiole*

inconspicuous. *Involucrellum* black, contiguous with the excipulum and extending to excipulum base-level, 30–60  $\mu\text{m}$  thick near the apex, 70–100  $\mu\text{m}$  thick at the base, frequently with a 15–20  $\mu\text{m}$  thick thalline covering. *Centrum* globose to obpyriform, 0.15–0.2 mm diam., IKI+ red-brown. *Excipulum* brown-black, 18–25  $\mu\text{m}$  thick. *Periphyses* simple, 25–40  $\times$  1.5–2.5  $\mu\text{m}$ . *Paraphyses* absent. *Asci* fissitunicate, clavate, 8-spored, 36–42  $\times$  12–17  $\mu\text{m}$ . *Ascospores* simple, colourless, ellipsoid to globose, massed or irregularly biseriate in the asci, (7–)10(–12.5)  $\times$  (5.5–)8(–10.5)  $\mu\text{m}$  (80 measured); contents clear to coarsely granular-guttulate. (Fig. 3)

#### NOTES

*Verrucaria meridionalis* has a very thin, filmy thallus, moderately large and superficial perithecia with a thick, smooth involucrellum and, importantly, mostly subglobose ascospores.

The new lichen is rather similar in appearance to the maritime New Zealand species *V. sessilis* P.M.McCarthy (1991c). That lichen, however, has a markedly

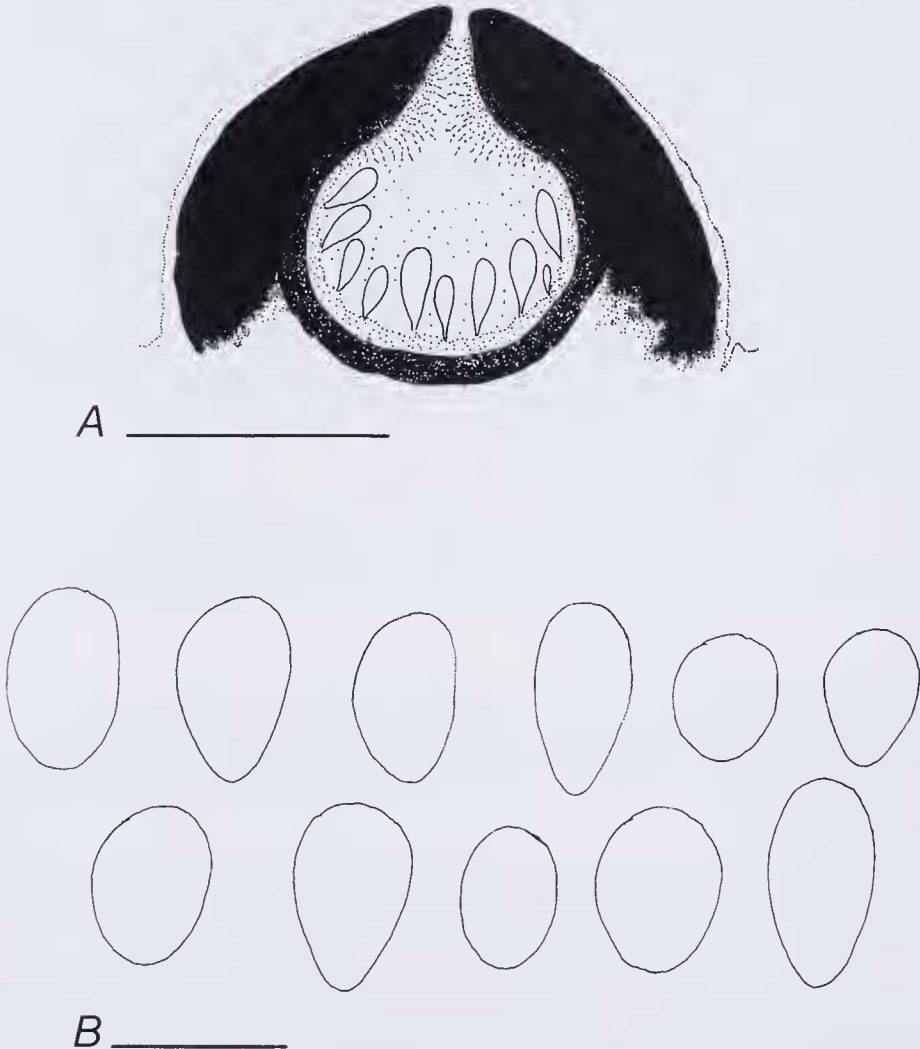


Fig. 3. *Verrucaria meridionalis*. a — vertical section of perithecium; scale 0.2 mm. b — ascospores; scale 10  $\mu\text{m}$ . (All from Holotypus.)

crateriform perithecial apex, an entire involucrellum, thicker excipulum, longer asci and persistently ellipsoid ascospores of  $9\text{--}16 \times 6\text{--}8 \mu\text{m}$  (McCarthy 1991a). Among other marine and maritime *Verrucaria* species known from Australia, *V. striatula* Wahlenb. shares rather prominent perithecia, but is readily distinguishable from *V. meridionalis* mainly by its normally more robust thallus and smaller, narrowly ellipsoid ascospores (McCarthy 1991b).

*Verrucaria meridionalis* is known only from intertidal rocks in a sheltered inlet on the south coast of New South Wales where it grows near barnacles and below *V. subdiscreta*.

#### 6. *Verrucaria subdiscreta* P.M.McCarthy, *Muelleria* 7: 327 (1991).

*Verrucaria subdiscreta* is known from supralittoral rocks on coasts of Western Australia, South Australia, Victoria, Tasmania and Macquarie Island (McCarthy 1991c). It is reported for the first time from New South Wales where it inhabits upper littoral rocks in a sheltered inlet.

#### SPECIMEN EXAMINED

*New South Wales* — Narooma District, Bodalla State Forest, 7 km E of Narooma, Wagonga Inlet picnic site, on soft shale in the upper littoral, 5 Feb. 1992, P.M.McCarthy 475 [part (MEL 1055262)].

#### ACKNOWLEDGEMENTS

I am grateful to Dr A. Aptroot and the curators of COLO-L, G, H and HO for the loan of specimens. Financial support for visits to G, GZU, H, UPS and W was provided by Australian Biological Resources Study.

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